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(54) **GUTTER FOR AN EVAPORATIVE PANEL OF A COOLING SYSTEM**

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CPC ***F24F 13/222*** (2013.01); *F24F 2013/227* (2013.01)

(58) **Field of Classification Search**
CPC F24F 13/222; F24F 2013/227
See application file for complete search history.

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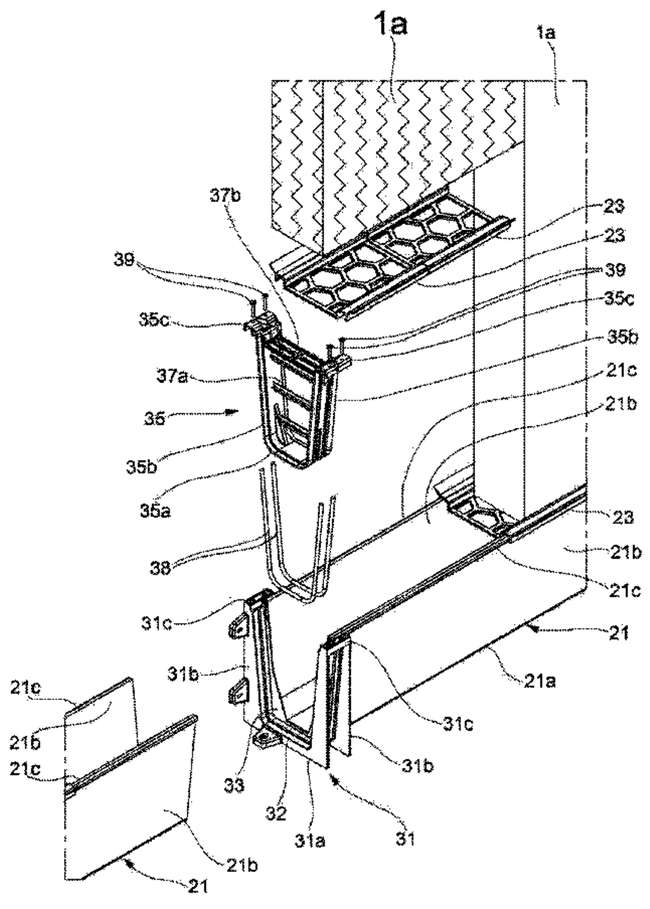
(57) **ABSTRACT**

A gutter for an evaporative panel of a cooling system having at least one channel with a bottom wall, a pair of opposing side walls ending at the top edges of the channel, at least one joint connecting one end of the channel to another component of the evaporative panel, the joint comprising, an outer part for coupling to an outer surface of the channel and having a pair of flanges to be arranged at the respective top edges of the channel, an inner part for coupling to an inner surface of the channel and having a pair of flanges to be arranged at the respective top edges of the channel, at least one gasket to be interposed between the inner part of the joint and the inner surface of the channel, and clamping to clamp the end of the channel between the inside and outside parts of the joint.

6 Claims, 5 Drawing Sheets



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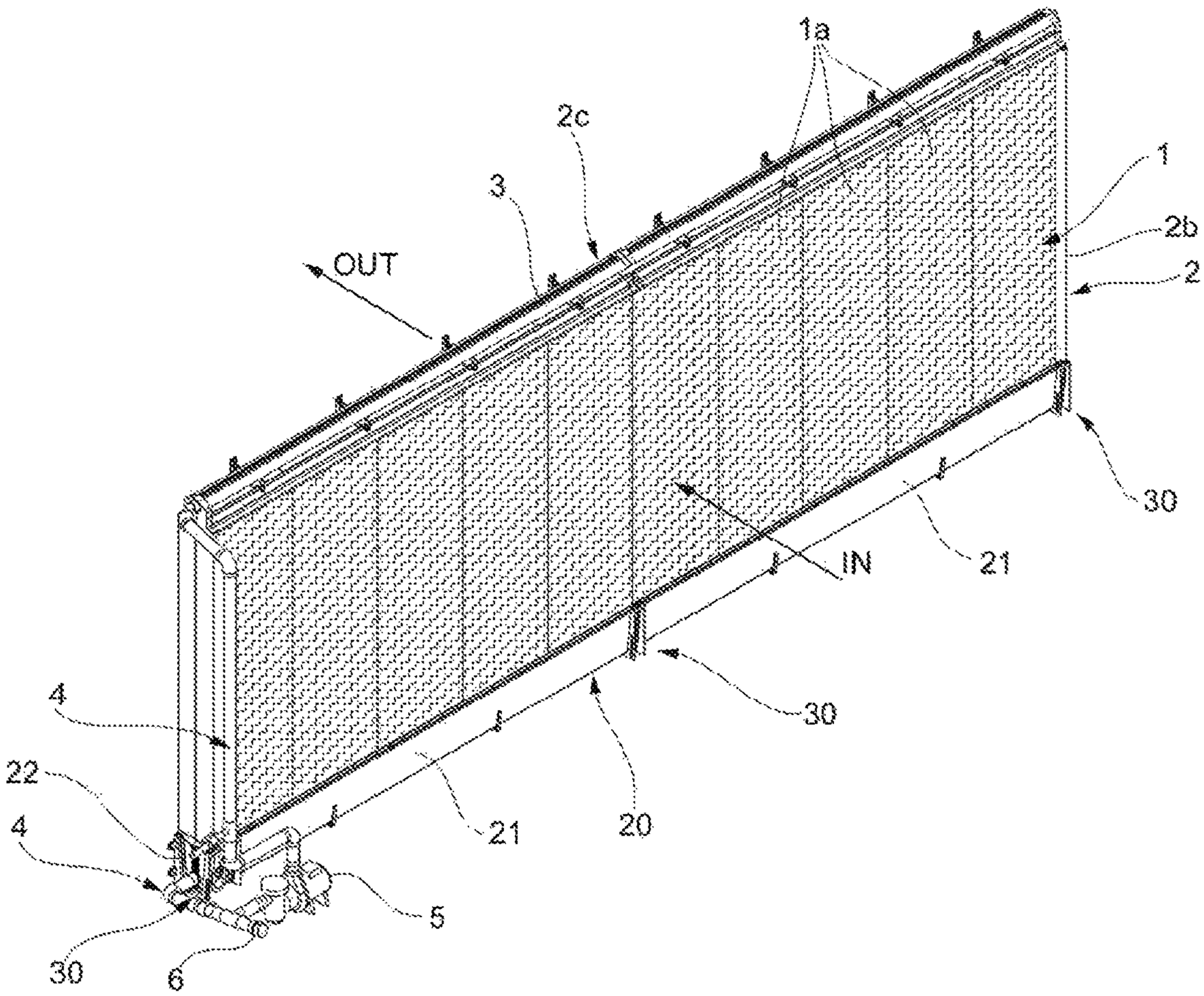


FIG. 1

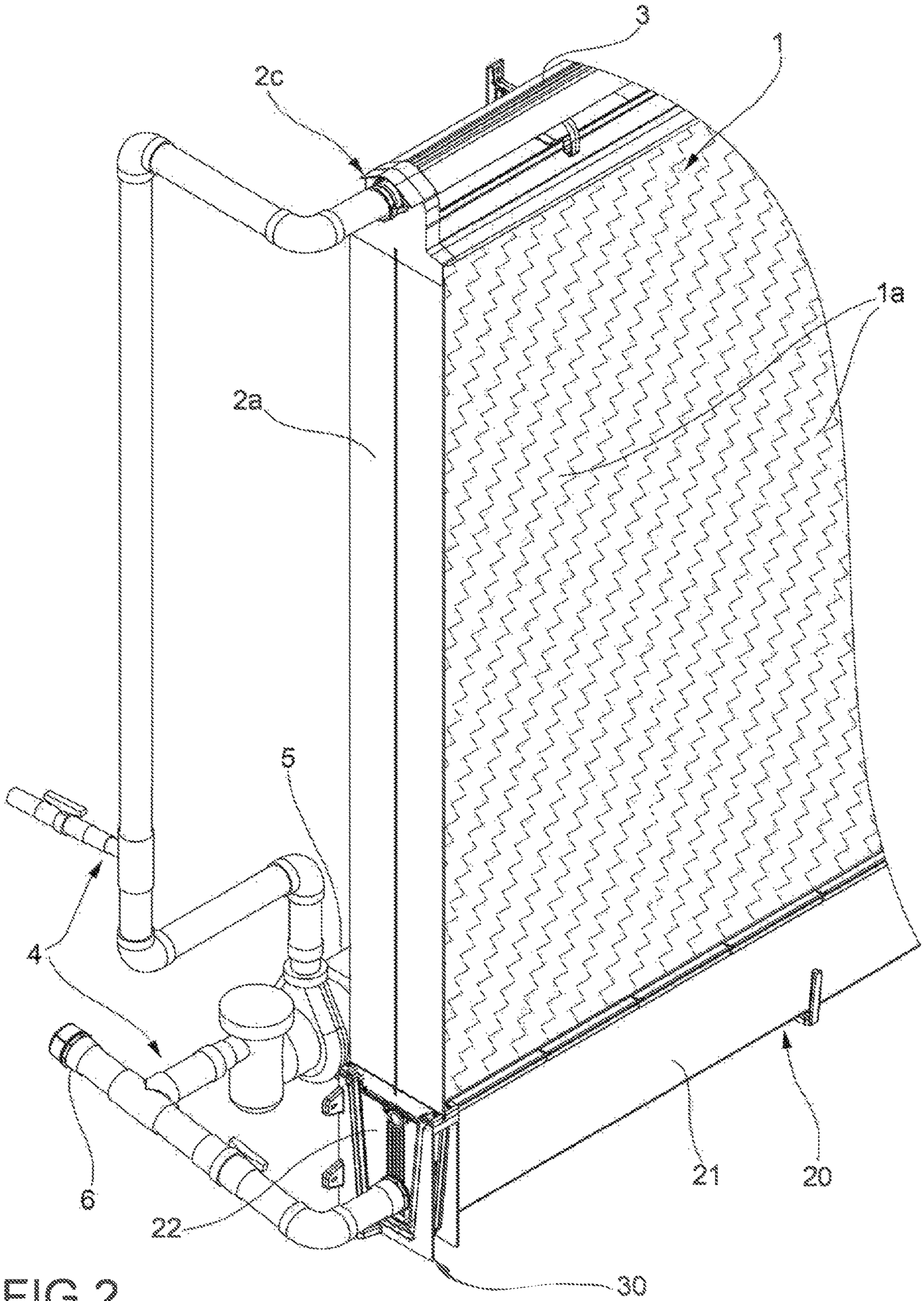
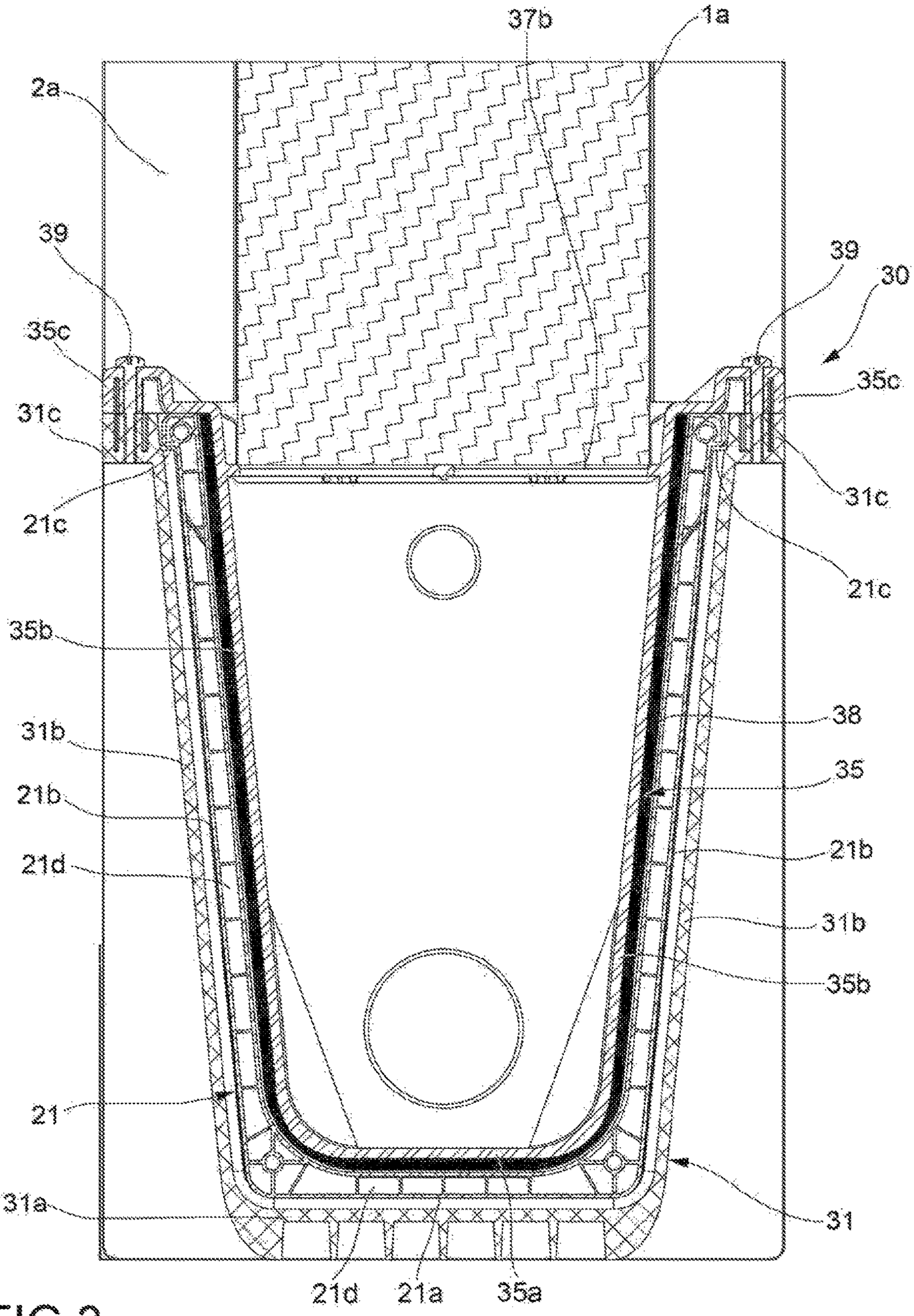


FIG.2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35c
31c
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38
35
21b
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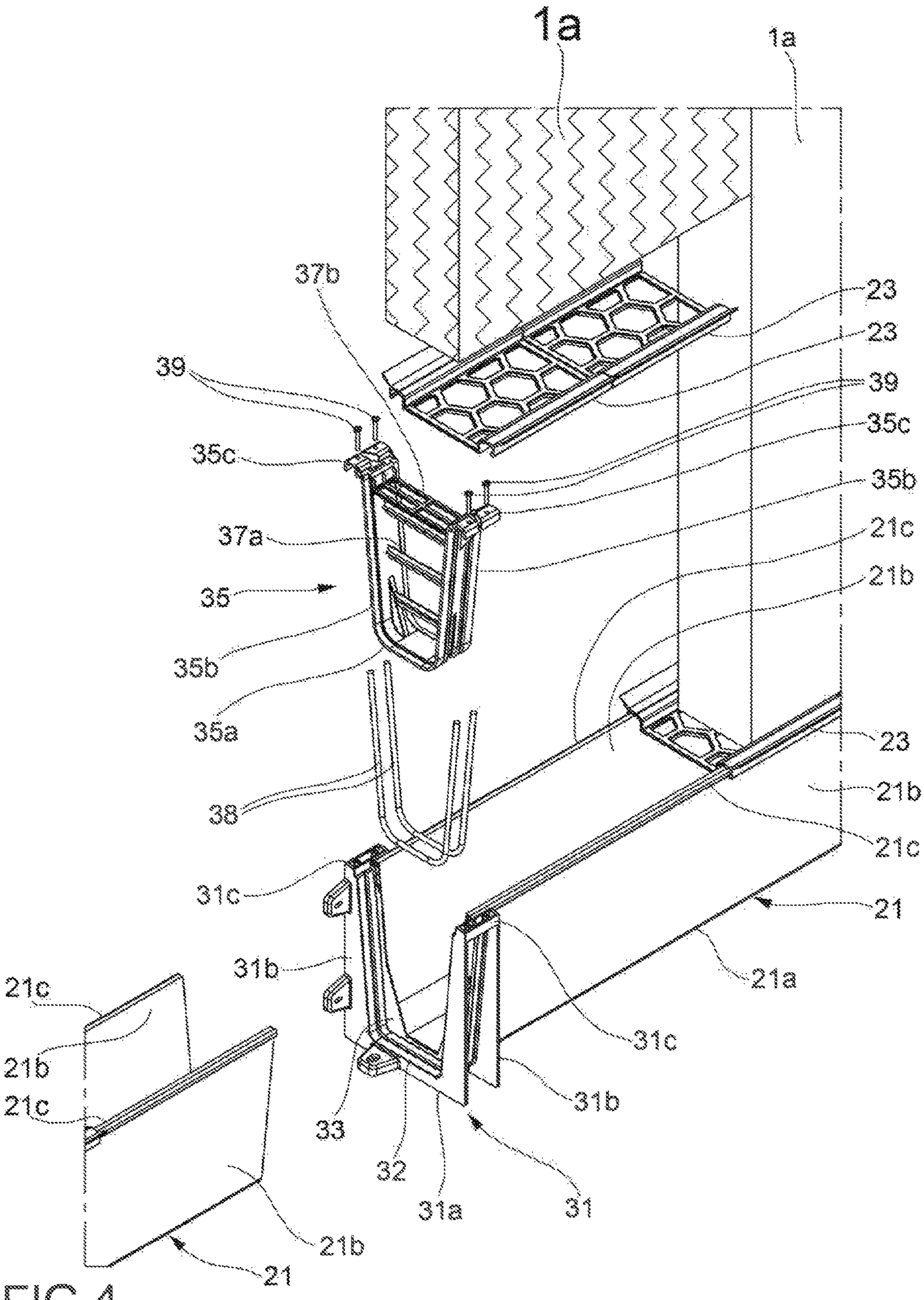
35b
31

FIG.3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21b
21c
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21c
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31a
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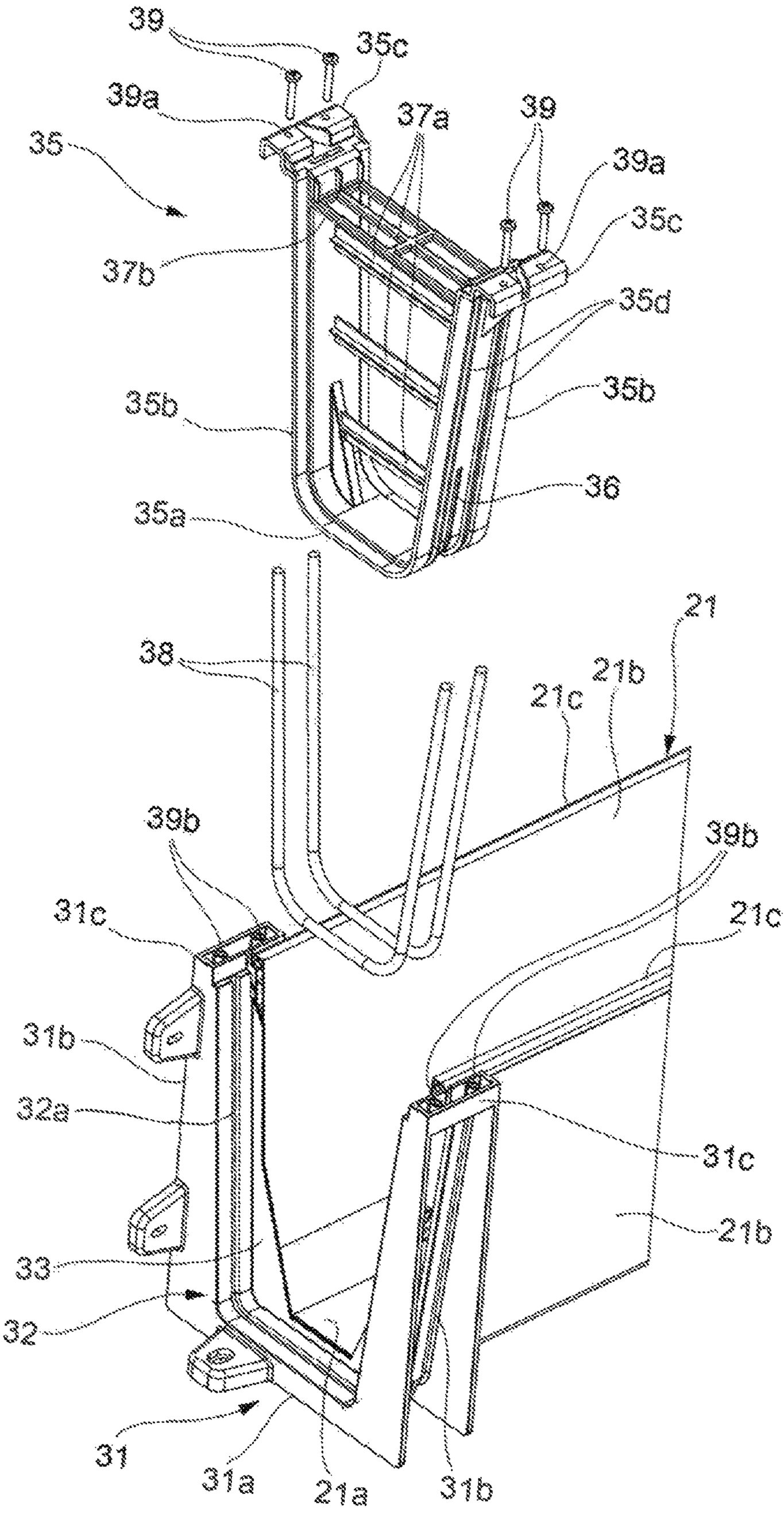
21b
21

FIG.4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21c
39b
39b
31c
21c
31b
32a
31c
21b
33
32
31
31a
21a
31b

FIG. 5

GUTTER FOR AN EVAPORATIVE PANEL OF A COOLING SYSTEM

The present invention refers in general to evaporative cooling systems, used, for example, for livestock and greenhouse facilities.

BACKGROUND

Such systems use water evaporation to cool the air that is circulated inside a barn or greenhouse by means of aeration systems. For this purpose, water-impregnated evaporative panels are used, which are arranged in openings made in the walls of the building and are made to be penetrated by a flow of air generated by an aeration system. The water in the panel evaporates, extracting heat from the surrounding air, and therefore the hot, dry air from the outside enters the cooler, more humid building. The water that does not evaporate, dripping downwards by gravity, collects in a gutter located below the panel, from which the water is drawn up by a pump and fed back to the distribution apparatus.

Evaporative panels generally are relatively large structures and are thus made by joining several elements together in order to cover the desired areas. In particular, the collection gutters are made by joining several consecutive elements in order to cover the entire width of the panel. The assembly generally takes place on site and provides for fixing and sealing the various elements of the gutter to each other. The fixing and sealing operation is carried out manually, and therefore the final result, in terms of sealing the gutter, depends on the skills of the operator. Moreover, it is also a time-consuming and resource-intensive process.

One object of the present invention is to make available a gutter for an evaporative panel of a cooling system that can overcome at least in part the aforementioned drawbacks.

BRIEF SUMMARY OF THE INVENTION

For this purpose, a gutter for an evaporative panel of a cooling system is the object of the invention, comprising

- at least one channel element comprising a bottom wall and a pair of opposing side walls extending from the bottom wall and ending at the respective top edges of the channel element, and
- at least one joint configured to connect one end of the channel element to another component of the evaporative panel, the joint comprising
- an outer part configured to be coupled to an outer surface of the channel element and provided with a pair of flanges suitable to be arranged at the respective top edges of the channel element,
- an inner part configured to be coupled to an inner surface of the channel element and fitted with a pair of flanges suitable to be arranged at the respective top edges of the channel element,
- at least one gasket suitable to be interposed between the inner part of the joint and the inner surface of the channel element, and
- clamping means acting on the flanges to clamp the end of the channel element between the inner part and outer part of the joint.

Preferred embodiments of the invention are defined in the dependent claims, which are intended as an integral part of the present description.

In a gutter according to the invention, the attachment of a channel element of the gutter to another component, such as another channel element or an end cap of the gutter, is achieved by means of a joint that may also ensure a seal between the elements. The joint thus facilitates assembly and sealing operations, for which the same level of expertise is not required as for conventional gutters. Moreover, assembly times are comparatively short.

BRIEF DESCRIPTION OF DRAWINGS

Further features and advantages of the gutter according to the invention will become more apparent in the following detailed description of an embodiment of the invention, made with reference to the accompanying drawings, provided purely to be illustrative and non-limiting, wherein:

FIG. **1** is a perspective view of a cooling system with evaporative panel;

FIG. **2** is an enlarged scale view of a detail of the system;

FIG. **3** is a cross-sectional view taken at a joint; and

FIGS. **4** and **5** are exploded views of the joint.

DETAILED DESCRIPTION

With reference to FIGS. **1** and **2**, an evaporative cooling system is represented. The system comprises an evaporative panel **1**, formed by a plurality of panel elements **1***a* placed side by side and supported by a structure **2** that surrounds the panel **1**. The elements of panel **1***a* are made of material chosen and configured in such a way as to allow, on the one hand, for them to be impregnated with water, and, on the other, for the air to pass through them. The direction of the air flow is represented by the IN and OUT arrows in FIG. **1**.

The structure **2** comprises two side panels, **2***a* and **2***b*, between which the evaporative panel **1** is laterally contained. An upper part **2***c*, in which a distribution apparatus **3** is arranged, is constructed as a pipe that extends along the entire width of the panel **1** and equipped with a plurality of spray nozzles or other dispensing members (not shown) distributed along the pipe so as to spray the panel with water as evenly as possible.

The structure **2** further comprises a lower part **20** constructed as a gutter, and suitable to collect the water that drips by gravity from the panel **1**.

The gutter **20** is conventionally connected to the distribution apparatus **3** by means of a recirculation pipe **4**, comprising a pump **5** to draw the water from the gutter **20** and to feed it to the distribution apparatus **3**.

The description of the aforesaid evaporative system is intended simply to frame the scope of the present invention and is therefore not to be considered binding.

With particular reference to FIGS. **3** to **5**, the gutter **20** comprises a plurality of consecutive channel elements **21**. Each end of each channel element **21** is sealingly connected to one end of an adjacent channel element **21**, or to another component of the panel, in particular an end cap of the gutter **21**. FIGS. **1** and **2** show one of such end caps, indicated at **22**, on which is arranged a fitting for connecting the gutter **21** to the recirculation pipe **4**.

Each channel element **21** is made in a single piece, in particular, of plastic material, but could be made of other materials, such as metallic materials. In the example shown, the channel elements **21** have an approximately trapezoidal cross section. Such shape is not, however, essential to the invention and may be different, e.g. semicircular, parabolic or semi-elliptical, or more generally it may also have a non-symmetrical shape. Each channel element **21** consists of a bottom wall **21***a* and a pair of side walls **21***b* opposite each other that extend from the bottom wall **21***a* and end in

respective top edges **21***c* of the channel element **21**. As may be seen in particular in FIG. **3**, each wall **21***a* and **21***b* is preferably constructed as a double wall with a cavity **21***d* inside. Such configuration is advantageous because it provides a double barrier that prevents water leaks to the outside in the event of cracks forming on the inside of the double wall.

As shown in FIG. **4**, a series of consecutive grid elements **23** is arranged along the gutter **20**, which rest on the top edges **21***c* of each channel element **21** and act as a support for the panel elements **1***a*, while at the same time allowing the water dripping from the panel elements **1***a* to collect in the gutter **20**.

The sealed connection between the channel elements **21**, and between the channel elements **21** and the end caps **22**, is made by means of joints **30**.

Each joint **30** comprises an outer part **31** formed as a single piece, in particular, made of plastic (or other materials), which is configured to be coupled to the outer surface of the channel element **21**. Consequently, the outer part **31** of the joint has a shape that matches the cross-sectional profile of the outer surface of the channel element **21**. The outer part **31** of the joint comprises a base portion **31***a*, which may be placed on a surface, and a pair of opposing side portions **31***b* that extend from the base portion **31***a*. At the top ends thereof, the side portions **31***b* end with their respective flanges **31***c* that extend laterally outwards. As may be seen in FIG. **3**, in use, the flanges **31***c* are arranged at the respective top edges **21***c* of the channel element **21**.

As may be seen in particular in FIGS. **4** and **5**, the outer part **31** of the joint **30** has a seat **32** in the shape of a saddle, defined by the inner surfaces of the base portion **31***a* and the side portions **31***b* of the outer part **31**. The seat **32** is suitable to receive the end of a respective channel element **21**. The outer part **31**, and in general the whole joint **30**, may have reflective symmetry with respect to a median plane, so as to allow the coupling of two gutter elements **21** arranged head to head with a single joint **30** (the term "median" is understood to refer to the direction defined by the longitudinal axis of the channel element **21**). The following description refers to only one of the symmetrical halves of the joint **30**, but it is intended that the features described concern both halves. However, the invention is not limited to the symmetrical example described herein, as the joint may also have a non-symmetrical shape.

In the seat **32** of the outer part **31** of the joint **30**, a partition **33** is preferably made, extending transversely inwards, arranged in particular at the median plane of the joint **30**. The partition **33** defines a reference axial position, and possible abutment, for the end of the channel element **21** (and therefore, on opposite sides, for the ends of two channel elements **21** placed head to head). In this regard, it may be provided that the end of the channel element **21** must be placed at a certain axial distance from the partition **33**, so as to have play that may compensate for the thermal expansion of the components that may occur in use.

In the seat **32** of the outer part **31** of the joint **30** a groove **32***a* may be obtained suitable to receive a possible gasket (not illustrated) to be interposed between the outer part **31** of the joint **30** and the outer surface of the channel element **21**. According to other embodiments, there may be more than one gasket between the outer part **31** of the joint **30** and the outer surface of the channel element **21**. Depending on other embodiments, the gasket(s) may be co-molded on the outer part **31** of the joint **30**.

Each joint **30** comprises moreover an inner part **35** formed as a single piece, in particular, made of plastic (or other materials), which is configured to be coupled to the inner surface of the channel element **21**. Consequently, the inner part **35** of the joint has a shape that matches the cross-sectional profile of the outer surface of the channel element **21**. The inner part **35** of the joint **30** has a saddle shape and comprises a bottom portion **35***a* and a pair of opposing side portions **35***b* that extend from the bottom portion **35***a*. At the top ends thereof, the side portions **35***b* end with their respective flanges **35***c* extending laterally outwards. As may be seen in FIG. **3**, in use, the flanges **35***c* of the inner part **35** of the joint **30** are arranged at the respective top edges **21***c* of the channel element **21** and are superimposed on the flanges **31***c* of the outer part **31** of the joint **30**.

By virtue of the arrangement described above, in use, the end of the channel element **21** is sandwiched between the outer part **31** and the inner part **35** of the joint **30**.

On each of the flanges **35***c* of the inner part **35** of the joint **30**, there is a pair of inspection through-slits **35***e*, each of which in use is located above the top edge **21***c* of the end of the respective channel element **21**. The inspection through-slits **35***e* are used to allow users to monitor, by observing through the slits **35***e* when the joint is closed, the positioning of the end of the channel element **21** with respect to the partition **33** made on the outer part **31** of the joint **30**. For this purpose, it may be provided that each slit **35***e* is sized in length in such a way as to provide visual feedback regarding the positioning of the end of the channel element. In this case, it may be envisaged that, if the end of the channel element **21** is positioned too far from partition **33**, then the slit **35***e* is "empty" inasmuch as, according to a plan view, there is no overlap between the slit **35***e* and the end of the channel element **21**. Conversely, if the end of the channel element **21** comes into contact with the partition **33** due to incorrect positioning or thermal expansion of the channel element **21**, then the slit **35***e* is "full" inasmuch as, according to a plan view, there is a total overlap between the slit **35***e* and the end of the channel element **21**.

On the outer side of the inner part **35** of the joint **30**, a slit **36** is preferably made to receive the partition **33** of the outer part **31** of the joint **30**. Moreover, on the inner part **35** of the joint **30**, one or more bridge portions **37***a*, **37***b* are made, extending between the side portions **35***b* of the inner part **35**. Some of the bridge portions, indicated at **37***b*, serve to stiffen the inner part **35** of the joint **30** and to prevent the side portions **35***b* from flexing inwards in use, which would result in a loss of effectiveness of the compressive action of the inner part **35** of the joint **30** on the inner surface of the channel element **21**. The upper bridge portion, indicated at **37***a*, is made as a grid and serves as a support for the overhanging panel element **1***a*.

On the outer side of the inner part **35** of the joint **30**, a groove **35***d* may be obtained suitable to receive a respective gasket **38** to be interposed between the outer part **31** of the joint **30** and the outer surface of the channel element **21**. According to further embodiments, there may be more than one gasket between the inner part **35** of the joint **30** and the inner surface of the channel element **21**. According to other embodiments, the gasket(s) may be co-molded on the inner part **35** of the joint **30**.

The joint **31** further comprises clamping devices **39** acting on the flanges **35***c* and **31***c* to clamp the end of the channel element **21** between the inner part **35** and outer part **31** of the joint **30**. In the example shown, the clamping devices **39** are made as screws that are inserted into holes **39***a* made in the flanges **35***c* on the inner part **35** of the joint **30** and coupled to threaded holes **39***b* made in the flanges **31***c* on the outer part **31** of the joint **30**. Clamping devices **39** may have other

configurations. For example, they could be made as snap-on devices, or as clips or clamps that embrace and fasten the flanges **35***c* and **31***c* together.

The invention claimed is:

1. A gutter for an evaporative panel of a cooling system, comprising

at least one channel element comprising a bottom wall and a pair of opposing side walls extending from the bottom wall and ending at the respective top edges of the channel element, and

at least one joint configured to sealingly connect one end of the channel element to another component of the evaporative panel, the joint comprising

an outer part configured to be coupled to an outer surface of the channel element and provided with a pair of flanges suitable to be arranged at the respective top edges of the channel element,

an inner part configured to be coupled to an inner surface of the channel element and provided with a pair of flanges suitable to be arranged at the respective top edges of the channel element,

at least one gasket suitable to be interposed between the inner part of the joint and the inner surface of the channel element, and

clamping means acting on the flanges to clamp the end of the channel element between the inner part and outer part of the joint,

wherein the outer part of the joint has a seat in the shape of a saddle, suitable to receive the end of the channel element, and the inner part of the joint comprises a corresponding bottom portion and a pair of opposing side portions extending from the bottom portion,

wherein in the seat of the outer part of the joint a partition is made, extending transversely inwards, said partition defining a reference axial position for the end of the channel element,

wherein on the inner part of the joint at least one bridge portion is made, extending between the side portions of the inner part, wherein said at least one bridge portion comprises an upper bridge portion made as a grid and serving as a support for a panel element of the evaporative panel.

2. A gutter according to claim **1**, further comprising at least one gasket suitable to be interposed between the outer part of the joint and the outer surface of the channel element.

3. A gutter according to claim **1**, wherein, on each flange of the inner part of the joint, an inspection through-slit is made, suitable to be placed above the respective top edge of the channel element to provide visual confirmation of the positioning of the end of the channel element with respect to the partition.

4. A gutter according to claim **1**, wherein the joint has reflective symmetry with respect to a median plane.

5. A gutter according to claim **1**, wherein the walls of the channel element are made as double walls.

6. A gutter according to claim **1**, further comprising at least one grid element arranged along the gutter and resting on top edges of the at least one channel element, said grid element acting as a support for a panel element of the evaporative panel.

* * * * *